drawing air into the enclosure from an environment containing the enclosure;

passing the air in the vicinity of the heat-generating equipment to absorb heat from the equipment;

passing the heated air through an air-to-liquid heat exchanger, whereby a cooling liquid absorbs heat from the air;

returning the air to the environment containing the enclosure; and

rejecting heat from the cooling liquid outside the environment containing the enclosure.

17. (AMENDED) The method of claim 16, further comprising modulating cooling liquid flow through the heat exchanger so as to regulate the temperature of the air returned to the environment to the ambient temperature of the environment containing the enclosure.

- **Please add new claims as follows.**

18. (NEW) The cooling system of claim 7, wherein the heat exchanger cools the temperature of the air exiting the enclosure to equal the ambient temperature of the air in the environment containing the enclosure.

19. (NEW) The cooling system of claim 12, wherein the heat exchanger cools the temperature of the air exiting the enclosure to equal the ambient temperature of the air in the environment containing the enclosure.

* * * * *

REMARKS

Claims 1-19 are currently pending. Claims 1-17 were pending prior to this response, and new claims 18-19 have been added. Claims 1-17 have been amended. A redline copy of all pending claims showing changes relative to the prior version is attached for the Examiner's convenience.

ELECTION/RESTRICTION

Applicant notes that the Examiner has acknowledged Applicant's election of the embodiment in Figure 8. However, Applicant reiterates that all claims are generic, *i.e.*, that all claims read on the various embodiments disclosed in the application. Furthermore, while Applicant agrees that Figures 6A, 6B and 8 each disclose a different species of the invention, Figures 1–5 generally illustrate generic aspects of the invention common to each species disclosed or that may be used in conjunction with any of the identified species and are unrelated to the defining characteristics of the species vis-à-vis the genus. Furthermore, Figure 7 illustrates in greater detail further aspects of the invention that may be used in conjunction with any of the species disclosed and are therefore unrelated to the defining characteristics of the various species.

DRAWINGS:

1. In paragraph two (2) of the Office Action, Examiner has objected to the drawings for failing to illustrate the various types of fans recited in claims 4 and 10. 35 U.S.C § 113 requires the applicant to "furnish a drawing *where necessary for the understanding of the subject matter to be patented.*" *See* 35 U.S.C. § 113(emphasis added). The types of fans recited in claims 4 and 10 are "designs that are known in the art" (*See* Applicant's specification page 12, line 3) and the selection "lies within the discretion of one having ordinary skill in the art" (*See* Applicant's specification page 10, lines 25-26). Applicant respectfully asserts that one skilled in the art would not need illustrations in addition to Figures 6A, 6B and 8 (all illustrating either a fan, a blower or an opening for receiving a fan) to illustrate the various types of commonly known and well understood fans/blowers to understand the present invention. Therefore drawings illustrating the various fan types in particularity are not required.

2. Applicant has corrected the informalities as requested by the Examiner in paragraph three (3) of the Office Action. Therefore, Applicant believes the drawings are now in condition for acceptance.

SPECIFICATION:

Applicant has amended the abstract pursuant to Examiner's objection in paragraph four (4) of the Office Action. Applicant has also amended the specification to correct minor

typographical errors and omissions pointed out by the Examiner as well as errors Applicant has noticed. No new matter has been introduced by these amendments and a redline copy of those amendments made are attached for the Examiner's convenience.

IN THE CLAIMS:

REJECTION UNDER 35 U.S.C. § 112:

Applicant has amended the claims in accordance with the various recommendations of the Examiner in paragraph eight of the Office Action. Accordingly, Applicant respectfully asserts that claims 1-17 as amended overcome the 35 U.S.C. § 112 rejections.

REJECTION UNDER 35 U.S.C. § 102:

1. In paragraph ten (10) of the Office Action, the Examiner rejected claims 1-3, 5, 8, 9, and 13-16 as allegedly anticipated by Parmerlee (4,315,300). In response, Applicant requests that the Examiner reconsiders and withdraws the rejection in view of the following.

For there to be anticipation under 35 U.S.C. § 102, "each and every element" of the claimed invention must be found either expressly or inherently described in a single prior art reference. *Verdegaal Bros. Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 1987; 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1986) and references cited therein. *See also Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 1571; 230 U.S.P.Q. 81, 84 (Fed. Cir. 1986) ("absence from the reference of any claimed element negates anticipation."); *In re Schreiber,* 128 F.3d 1473, 1477; 44 U.S.P.Q.2d 1429, 1431 (Fed. Cir. 1997).

Parmerlee discloses a system that blows cooled air into the enclosure to cool the components, not a system for absorbing the heat generated from the components from the air exiting the enclosure as claimed by Applicant. Specifically, Parmerlee discloses that "[c]ool air is directed through . . . slots and this air moves across the faces of the modules to facilitate the removal of heat." *See* Parmerlee col. 2, line 67 – col. 3, line 1. Parmerlee also discloses "fans are blowing cool air through slots so that heat is readily removed from the components." *See* Parmerlee col. 4, lines 4-6.

Applicant respectfully directs the Examiner to Applicant's specification page 8, lines 17-31, which describes the advantage of Applicant's system in that it prevents condensation on or near the electronic equipment because Applicant's system does not directly cool the air entering

the enclosure. Applicant purposefully does not cool the air in this manner because when air is cooled within the enclosure, such as disclosed by Parmerlee, the risk of condensation increases. Applicant's claims are limited to cooling air exiting the enclosure, which obviously, has already been heated by the electronic equipment.

Additionally, Parmerlee does not disclose or suggest expelling the heat outside the environment containing the enclosure, which is another limitation found in Applicant's independent claims 1, 8, 15 and 16. This is an important feature of Applicant's invention because by expelling the heat outside of the environment, the heat load on the air conditioning unit in the environment is minimized.

As the above described limitations are not disclosed or suggested by Parmerlee, Applicant requests that the Examiner reconsider and withdraw Examiner's rejection of claims 1-3, 5, 8, 9, and 13-16 and asks that the Examiner indicate the allowance of these claims in the next paper from the Office.

2. In paragraph eleven (11) of the Office Action, the Examiner rejected claims 1, 3 and 6 as allegedly being anticipated by Cowans (5,471,850). In response, Applicant requests that the Examiner reconsiders and withdraws the rejection in view of the previously stated requirements for an anticipation rejection and the following.

Cowans discloses a system to directly cool circuits (-50° C) so that they achieve desired performance characteristics. *See* Cowans col. 1, lines 41-44. Specifically, to cool the circuits Cowans discloses piping subcooled fluid, such as "[r]efrigerant in the gas phase," to a "cold probe in contact with a heat sink that is conductively coupled to an individual circuit unit." *See* Cowans col. 2, lines 31-34. The limitations described above pertinent to Parmerlee are also not disclosed or suggested by Cowans. These limitations include cooling the air exiting the enclosure and releasing this heat outside of the environment containing the enclosure.

As the above described limitations are not disclosed or suggested by Cowans, Applicant requests that the Examiner reconsider and withdraw Examiner's rejection of claims 1, 3 and 6 and asks that the Examiner indicate the allowance of these claims in the next paper from the Office.

3. In paragraph twelve (12) of the Office Action, the Examiner rejected claims 1, 3, 6, 8, 9 and 13-16 under § 102(e) as allegedly being anticipated by Chu (6,205,796). In response, Applicant requests that the Examiner reconsider and withdraw the rejection in view of the previously stated requirements for an anticipation rejection and the following.

Chu again discloses a system that directs cooled air into the enclosure. As noted above, Applicant's claims are directed to a system that cools the air exiting the enclosure. Moreover, Chu discloses a humidity control unit for removing moisture. *See* Chu col. 4, lines 49-53. This is necessary because Chu's invention is "directed to cooling electronic computer systems to temperatures which are sufficiently low that moisture condensation becomes a problem." *See* Chu col. 1, lines 6-9. As stated previously, Applicant's claimed system cools the air exiting the enclosure so that there is no risk of condensation in the enclosure, as such a humidity control unit is not needed. In addition to failing to disclose or suggest the elements recited in Applicant's claims Chu clearly teaches away from the present invention. Therefore, in light of the foregoing the present invention is believed to be patentable over Chu, as well as Parmerlee and Cowans.

As the above described limitations are not disclosed or suggested by Chu, Applicant requests that the Examiner reconsider and withdraw Examiner's rejection of claims 1, 3, 6, 8, 9 and 13-16 and asks that the Examiner indicate the allowance of these claims in the next paper from the Office.

REJECTION UNDER 35 U.S.C. § 103:

In paragraph fourteen (14) of the Office Action, Examiner has rejected Applicant's claims 4 and 10 as allegedly being unpatentable under 35 U.S.C. §103 over Parmerlee. Applicant requests that the Examiner reconsider and withdraw the above rejection of the claims in view of the following:

1. The fundamental basis for an obviousness determination under 35 U.S.C. §103(a) was set forth by the Supreme Court in *Graham v. John Deere Co.,* 383 US 1; 148 U.S.P.Q. 459. In subsequent cases involving a determination of obviousness under 35 U.S.C. §103, the Federal Circuit has noted that the following basic tenets of patent law must be adhered to: 1) the claimed invention must be considered as a whole; 2) the references must be considered as a whole and must suggest the desirability and, thus, the obviousness of making the combination; 3) the references must be viewed without the benefit of impermissible hindsight vision afforded by the

claimed invention; and 4) reasonable expectation of success is the standard with which obviousness is determined. *Hodosh v. Block Drug Co., Inc.,* 786 F.2d 1136, 1143 n.5, 229 U.S.P.Q. 182, 187, n.5 (Fed. Cir. 1986). The Federal Circuit has further indicated that any inquiry under 35 U.S.C. §103 is highly fact specific by design and that there are no *per se* rules of patentability. *In re Ochiai*, 71 F.3d 1565, 1569; 37 U.S.P.Q. 1127, 1131 (Fed. Cir. 1995). Recent binding precedent from the Federal Circuit also indicates that rejections must be based on and supported by the evidence present in the prosecution record and not on the unsupported asserts and allegations of the Examiner as to the content of the prior art. *In re Zurko,* No. 96-1258 (Fed. Cir. 2001), and *In re Sang-Su Lee*, slip op. No. 00-1158 (Fed. Cir. Jan. 18, 2002) *see also* 37 CFR. 1.104(d). "Both the suggestion and the expectation of success must be founded in the prior art, not in the Applicant's disclosure." *In re Dow Chem.*, 837 F.2d 469, 473, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988); *see also In re Sang-Su Lee*, slip op. No. 00-1158 (Fed. Cir. Jan. 18, 2002).

2. As stated previously, Parmerlee fails to disclose, teach or suggest the above-designated limitations that are found in Applicant's independent claims, namely, cooling air exiting the enclosure and expelling the heat outside the environment containing the enclosure. Therefore, Parmerlee whether alone or in combination with prior art of record cannot render Applicant's claims unpatentable under 35 U.S.C. §103. *See* MPEP § 2143.

In view of the foregoing, it is respectfully requested that claims 1-19 be reconsidered and allowed. The Examiner is invited to contact the undersigned attorney at 713-268-1388 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

Date: 01/22/03

By _____

Billy C. Allen III
Reg. No. 46,147
HOWREY SIMON ARNOLD & WHITE, LLP
750 Bering Drive
Houston, Texas 77057-2198
Telephone: 713.268.1388
Facsimile: 713.787.1440

Attorney for Applicant

- **Please amend the abstract as follows.**

The present invention is ~~directed to~~ a cooling apparatus and method, and more particularly, an apparatus and method for cooling the air exiting an electronics enclosure. Air is taken into the enclosure and heated by the electronic equipment. The air is then expelled through a heat exchanger, which cools the exiting air. The exiting air is cooled using an external source of cooling liquid, which absorbs the heat from the exiting air. This absorbed heat is then expelled from the liquid outside of the environment containing the enclosure. Cooling the air exiting the enclosure causes the enclosure to present a neutral heat load to a room containing such an enclosure. Cooling the exiting air obviates the necessity of increasing the room air conditioning capacity to account for the heat added to the room by the electronics within the enclosure. Further, the invention decreases the possibility of moisture condensation within the enclosure and also provides a more efficient cooling system than is available from prior art devices and techniques.

- **Please amend the paragraph on page 9, lines 3-10 with the following.**

Conversely, using the present invention, the ambient air enters the enclosure at a typical temperature of 75 degrees Fahrenheit and a typical relative humidity of 50 percent. The air is heated by the electronic components to a typical temperature of 95 degrees Fahrenheit. This decreases the relative humidity of the air to approximately 26 percent. When the heat is removed by the heat exchanger, the relative humidity again increases to a typical value of 50 percent. Because the air ~~is~~ always contains a relatively low amount of water as compared to saturation, the possibility of condensation is virtually non-existent.

- **Please amend the paragraph on page 11, lines 16 – 23 with the following.**

Thermostatic valve ~~330~~320 has a thermostatic operator 322 that changes the valve position according to temperature control. A temperature sensor and other required controls (not shown) operate thermostatic valve ~~330~~320. The valve controls the flow of cooling fluid in the heat exchanger and ensures that the air exiting the heat exchanger is at the same temperature as the room temperature of the computer room in which the enclosure is housed. Thermostatic

valve 320 attaches to a tee coupling 312 that connects the valve to adapters 310, 310'. Adapters 310, 310' connect to the external cooling source and returns cooling fluid to the external cooling source.

- **Please amend the paragraph on pages 11-12, lines 24 - 4 with the following.**

Another embodiment of the invention is illustrated in Figure 8. In this embodiment, cooling apparatus 250 is contained within the ~~cabinet~~ enclosure 210 and mounted on rack 220. The general principles of operation of this embodiment are substantially the same as the embodiments discussed above, however, the airflow path is different. In the airflow path of the present embodiment, air is drawn in through the front 212 of enclosure 210. After passing through electronics 240 and absorbing heat therefrom, the air passes through the interior of enclosure 210 and is drawn back through cooling apparatus 250. Cooling apparatus 250, which operates in the same manner as described for the previous embodiment absorbs the heat from the air flow and rejects this heat into the cooling fluid delivered to the external source (not shown). Blower 280 draws air through the cooling apparatus, which may be of the designs that are known in the art. The cooled air then returns to electronics 240 again traveling through enclosure 210.

1. (AMENDED) A cooling system for an enclosure containing heat-producing equipment, ~~said~~the cooling system comprising an air-to-liquid heat exchanger~~;~~, wherein ~~said~~the heat exchanger absorbs heat from air exiting ~~said~~the enclosure and expels the heat outside an environment containing ~~said~~the enclosure.

2. (AMENDED) The cooling system of claim 1, wherein ~~said~~the heat exchanger further comprises an air vent, whereby air present in ~~said~~the heat exchanger is expelled when ~~said~~the heat exchanger is charged with liquid.

3. (AMENDED) The cooling system of claim 1, further comprising a fan situated to move air through ~~said~~the heat exchanger.

4. (AMENDED) The cooling system of claim 3, wherein ~~said~~the fan is selected from the group consisting of a centrifugal blower, a cross-flow blower, an axial fan and a plug fan.

5. (AMENDED) The cooling system of claim 3, wherein ~~said~~the heat exchanger and ~~said~~the fan are attachable to ~~said~~the enclosure.

6. (AMENDED) The cooling system of claim 1, further comprising a valve for regulating ~~refrigerated~~cooling liquid flow through ~~said~~the heat exchanger.

7. (AMENDED) The cooling system of claim 6, further comprising:

a temperature sensor for sensing ~~a~~the temperature of air exiting ~~said~~the heat exchanger; and

a temperature controller coupled to ~~said~~the sensor ~~and~~ for modulating ~~said~~the valve in response to ~~said~~the temperature of ~~said~~the air exiting ~~said~~the enclosure. ~~a temperature approximately equal to the air in the environment.~~

8. (AMENDED) An enclosure containing heat-producing equipment, comprising:

an air inlet for admitting air from an environment containing ~~said~~the enclosure, wherein ~~said~~the air absorb~~s~~ing heat from ~~said~~the equipment;

an air outlet for expelling the heated air from ~~said~~the enclosure; and

an air-to-liquid heat exchanger adjacent to ~~said~~the air outlet, ~~said~~the heat exchanger absorbing heat from ~~said~~the heated air and expelling ~~said~~the heat outside ~~said~~the environment using a ~~refrigerated~~cooling liquid as a heat transfer medium.

9. (AMENDED) The enclosure of claim 8, further comprising a fan disposed to force air through ~~said~~the heat exchanger.

10. (AMENDED) The enclosure of claim 9, wherein ~~said~~the fan is selected from the group consisting of a centrifugal blower, a cross-flow blower, an axial fan and a plug fan.

11. (AMENDED) The enclosure of claim 10, further comprising a modulating valve for regulating ~~refrigerated~~cooling liquid flow through ~~said~~the heat exchanger.

12. (AMENDED) The enclosure of claim 11, further comprising a temperature sensor sensing temperature of the air exiting ~~said~~the heat exchanger and a temperature controller modulating ~~said~~the valve in response to ~~said~~the temperature exiting the heat exchanger. ~~to ensure that the air exiting said heat exchanger is at a temperature approximately equal to a temperature of said~~ environment.

13. (AMENDED) An enclosure containing heat-producing equipment, comprising:

an air inlet for admitting air from an environment containing ~~said~~the enclosure, ~~said~~the air absorbing heat from ~~said~~the equipment,

an air outlet for expelling the air from ~~said~~the enclosure;

means for exchanging heat from the air with a ~~refrigerated~~cooling liquid;

whereby the air returns to ~~said~~the environment at a temperature ~~approximately~~ equal to the ambient temperature of ~~said~~the air in the environment.

14. (AMENDED) The enclosure of claim 13, further comprising means for moving the air through ~~said~~the means for exchanging heat.

15. (AMENDED) A cooling apparatus for an enclosure containing heat-producing equipment, comprising:

an air-to-liquid heat exchanger installed in ~~said~~the enclosure, ~~said~~the heat exchanger absorbing heat from air passing through ~~said~~the heat exchanger and rejecting the heat outside an environment containing ~~said~~the enclosure; and

a fan disposed to induce airflow through ~~said~~the heat exchanger.

16. (AMENDED) A method for cooling an enclosure containing heat-generating equipment, the method comprising:

drawing air into ~~said~~the enclosure from an environment containing ~~said~~the enclosure;

passing the air in the vicinity of ~~said~~the heat-generating equipment to absorb heat from ~~said~~the equipment;

passing the heated air through an air-to-liquid heat exchanger, whereby a ~~refrigerated~~cooling liquid absorbs heat from the air;

returning the air to ~~said~~the environment containing the enclosure; and

rejecting heat from ~~said~~the ~~refrigerated~~cooling liquid outside ~~said~~the environment containing ~~said~~the enclosure.

17. (AMENDED) The method of claim 16, further comprising modulating ~~refrigerated~~cooling liquid flow through the heat exchanger so as to regulate ~~a~~ the temperature of ~~said~~the air returned to ~~said~~the environment ~~at a temperature approximately equal to a~~to the ambient temperature of ~~said~~the environment containing the enclosure.

18. (NEW) The cooling system of claim 7, wherein the heat exchanger cools the temperature of the air exiting the enclosure to equal the ambient temperature of the air in the environment containing the enclosure.

19. (NEW) The cooling system of claim 12, wherein the heat exchanger cools the temperature of the air exiting the enclosure to equal the ambient temperature of the air in the environment containing the enclosure.